REMARKS

The Office Action dated December 13, 2005 has been received and carefully reviewed. Applicants note the indication in the Office Action that the drawings filed on April 30, 2004 have been accepted. By the above amendment, claims 1, 101, and 125 have been amended to further clarify the patentable distinctions with respect to the cited art and to correct minor grammatical errors. The claims were rejected in the Office Action as obvious with respect to an article published by the Lincoln Electric Company in combination with one or more prior Lincoln patents under 35 U.S.C. §103, wherein Applicant requests reconsideration of the pending claims in view of the above amendments and the following remarks.

I. REJECTION OF CLAIMS 1, 8-10, 13, AND 14 UNDER 35 U.S.C. § 103

Claims 1-8, 19-26, 31-40, 43-47, 50-60, 64-76, 80-92, and 96-100 stand rejected under 35 U.S.C. §103 as unpatentable over the Lincoln Electric article entitled "Another Arc Welding Development The Lincoln One Side System" (the Lincoln Article) in view of Stava 6,207,929 (Stava '929). Reconsideration and withdrawal of these claim rejections is respectfully requested for at least the following reasons.

The present invention relates to electric arc welders for depositing weld metal using two or more consumable welding electrodes, and can be successfully employed in tandem and other welding processes involving series connection of two welding electrodes. The examples shown in the specification and drawings provide a modification of traditional series connected electrode concept with greater control of welding currents and wire feed speeds to facilitate welding with a large variety of currents and a large variety of electrodes sizes and materials. The novel welders represent a substantial advance in the electric arc welding field, allowing the enhanced deposition rates, controlled weld puddle dynamics, and other advantages of the modified series connected electrode configuration to be applied in submerged arc and other welding applications spanning a wider range of current levels and electrode sizes and materials than was previously thought possible. In particular, the modified series circuit connections facilitate enhanced deposition rates by virtue of an arc between the electrodes, as well as another arc to the workpiece to provide controlled workpiece heating and penetration. The use of an advanced waveform

controlled power source providing waveforms with an independently adjustable frequency, alone or in combination with independently controlled wire feed speeds allows adaptation of the modified series configuration to different electrodes, current levels, etc., by which the series welding technique finds practical utility in many different welding applications. Prior to the present invention, systems, such as those shown in the Lincoln article, found limited success, due in part to the fixed frequency AC welding signals supplied thereby.

Independent claim 1 recites an electric arc welder comprising first and second electrodes separately driven toward a point in a weld groove, along with a main power source with a first output terminal connected to the first electrode and a second output terminal connected to the second electrode and to the workpiece, to provide a modified series arc welding configuration. Examples of this electrode/power source interconnection scheme are illustrated in FIGURES 17, 20, and 21 of the present application. The power source of claim 1, moreover, is comprised of a high speed switching output stage for creating a current waveform *via* a waveform generator controlling a pulse width modulator circuit. As amended above, moreover, the welder of amended claim 1 provides an AC current waveform having an independently adjustable frequency that is unrelated to the line frequency of line voltage provided to the main power source.

The Office Action references a diagram on page 2 of the Lincoln article, labeled "Modified Series Arc System...", and asserts that it would have been obvious to have used any well known type of power supply in the system of the Lincoln Article. This Lincoln article presents the series welding configuration using an IDEALARC® AC-1200 power source, as generally discussed in the background section of the current specification with respect to incorporated reference Shutt 4,246,463. The Lincoln AC-1200 power sources are not waveform controlled, but rather, provide AC welding at a frequency controlled by the input line power, such as 50 or 60 Hz. For this reason, single side modified series welding as depicted in the referenced diagram of the Lincoln article was not extensively adopted. Additionally, the wire feeders for the electrodes in the system shown in the article and in Shutt 4,246,463 were controlled by the same power source (see for example, Shutt FIGURE 1), thereby fixing the relationship of the two motors driving the wire feeders. As a result, the potential advantages of the modified series arrangement could be accomplished in only a relatively small range of currents and with only certain limited electrode sizes,

wherein broad use of this system required tuning of the current and input line frequency for proper melting, penetration, and wire feed speed. Consequently, the advantages of modified series connected electrodes in welding have not been widely achievable using the system of the Lincoln article. Importantly, there is no indication in the Lincoln article or Shutt of any of these or other shortcomings of the modified series arrangement illustrated therein. In particular, the cited Lincoln article provides no discussion of the above mentioned difficulties, nor does the article suggest any solutions or modifications to the system.

The Office Action proposes combination of the system of the Lincoln article with the secondary reference Stava '929. In particular, the Office Action asserts that it would have been obvious to have used any well known type of power supply in the system of the Lincoln article, and that motivation for the proposed combination is found in the teachings of Stava '929 that such is advantageous for tandem arc welding, citing to Fig. 2 and the associated discussion, and to column 4, of Stava '929.

Applicants submit that there is no motivation or reasonable expectation for success in attempting the proposed combination of the system of the Lincoln article with the teachings of Stava '929. As an initial matter, the Lincoln article provides no suggestion that a welding power source waveform generated by a waveform generator controlling a pulse width modulator circuit is desirable or advantageous. In addition, Stava '929 is silent with respect to the need for improvements over the modified series system of the Lincoln article. Moreover, Stava '929 is silent with respect to series welding generally, and appears to teach away from usage in series welding systems generally.

Stava '929 provides welding waveforms of different frequencies and/or at different relative phase angles to the tandem electrodes where the separate power supplies of Stava '929 are not connected in series. In this regard, the cited portions of Stava '929, and the reference as a whole, are illustrative of the advantages of two separately connected power sources operated at different frequencies or at different phases in addressing the arc interference problems of non-series tandem welding operations. For instance, Stava '929 provides many different embodiments in which the waveform applied to a first tandem electrode is at a first frequency, while the second tandem electrode is energized at a different frequency. In some of these examples, one or both of the power sources may be

operated at frequency that is swept in a range, such as 10 to 100 Hz, or 50 to 200 Hz, wherein the waveforms are not synchronized (*e.g.*, col. 4, lines 11-48, as well as Figs. 2, 4, 6, 8, and the description thereof). Other embodiments of Stava '929 involve use of a synchronizing signal and a delay to provide the low frequencies of the welding currents out of phase (*e.g.*, col. 5, lines 23-52). In addition, the objectives of Stava '929 appear to be directed to solving arc interference problems through separate (i.e. non-series) excitation of tandem electrodes (*e.g.*, col. 5, line 53 through col. 6, line 8). Moreover, the advantages of Stava '929 are stated to be achievable using many different power supply architectures that provide the ability to control the low frequencies of the output currents independent of each other (col. 5, lines 7-22).

Thus, a person of ordinary skill in the art attempting to construct a series welding system at the time of the present invention would not look to the teachings of Stava '929 and would not interpret these advantages to mandate the use of pulse width modulators controlled by a waveform generator as in claim 1. Instead, in consulting the modified series connected system shown in the Lincoln article, a skilled artisan would not believe that the stated advantages of Stava '929 would be possible in a series connection, and would therefore not be motivated to attempt the combination proposed in the Office Action. Applicants therefore submit that neither the Lincoln article, nor Stava '929 provide any motivation for the present invention, as set forth in claims 1-8, 19-26, 31-40, 43-47, 50-60, 64-76, 80-92, and 96-100, and accordingly request reconsideration and withdrawal of the rejections thereof under 35 U.S.C. §103.

II. REJECTION OF CLAIMS 9-16, 41, 42, 48, 49, 61-63, 77-79, AND 93-95 UNDER 35 U.S.C. § 103

Claims 9-16, 41, 42, 48, 49, 61-63, 77-79, and 93-95 were rejected under 35 U.S.C. §103 as being unpatentable over the Lincoln article taken with Stava '929 as applied to claims 1-8, 19-26, 31-40, 43-47, 50-60, 64-76, 80-92, and 96-100 above, and further in view of Stava 6,291,798 (Stava '798). Reconsideration and withdrawal of these claim rejections is respectfully requested for at least the following reasons.

Applicants initially note that rejected claims 9-16, 41, 42, 48, 49, 61-63, 77-79, and 93-95 ultimately depend from independent claim 1. As discussed in the previous section, there is no motivation, suggestion, or reasonable expectation of success in the references

or in the prior art generally for attempting to combine the teachings of Stava '929 with the modified series configuration of the Lincoln article, whereby independent claim 1 is believed to be patentably distinct from the proposed combination thereof. Applicants submit that Stava '798 also fails to provide any suggestion for combining the teachings of Stava '929 with a series arc welding configuration. Therefore, independent claim 1 and claims 9-16, 41, 42, 48, 49, 61-63, 77-79, and 93-95 are patentably distinct from the proposed combination of the Lincoln article with Stava '929 and Stava '798 for this reason.

Dependent claims 9-16 are directed to the arc welder of independent claim 1, and further specify power source modules connected in parallel with the main power source output terminals. Claims 41, 42, 48, 49, 61-63, 77-79, and 93-95 depend directly or indirectly from claims 9-16 and add further distinguishing features, wherein claims 41 and 42 recite a back plate below the groove under the workpiece, claims 48 and 49 provide for a flux dispenser in front of a third electrode, claims 61-63 and 77-79 specify that the waveform generator of the main power source includes a circuit to adjust the AC waveform frequency and a duty cycle adjustment circuit, respectively, and claims 93-95 recite a circuit to adjust the relative positive and negative portions of the AC waveform of the main power source.

The provision of parallel connected modules per claims 9-16 is neither taught nor suggested by the proposed combination of the Lincoln article with Stava '929 and Stava '798. The Office Action asserts in paragraph 3 that it would have been obvious to have used parallel connected power supplies in the combination of the Stava '929 with Lincoln article, with the motivation being the teachings of Stava '798 that such are useful, in reference to Fig. 1 and the associated discussion in Stava '798. Applicants note that the parallel connection illustrated in Fig. 1 of Stava '798 provides connection of output stages 22 and 202 in parallel to the input terminals 30 and 32 of a polarity switching circuit 12. In this regard, neither of the parallel power sources in Fig. 2 of Stava '798 are connected to the electrode E, whereas both modules in claims 9-16, 41, 42, 48, 49, 61-63, 77-79, and 93-95 are connected to the welding electrode (i.e. at the first output terminal of the main power source).

Independent claim 1 provides a main power source with a first output terminal connected to the first electrode and a second output terminal connected both to the second

electrode and directly or indirectly to the metal workpiece. Claims 9-16 and their dependent claims further provide that the main power source includes first and second module power sources connected in parallel with the main power source output terminals. One possible example of the claimed parallel module connection is shown in Fig. 2 of the present application, wherein the AC current is combined at the weld station WS (i.e. the modules 30 and 32 are connected in parallel across the welding electrode E and the workpiece W). These claims, therefore, provide for parallel connection of modules to provide an AC welding current waveform from the main power source, whereas the parallel inverters in Fig. 1 of Stava '798 each provide a portion of a combined DC current that is then fed to a single polarity switching network 12. Thus, the individual modules of Stava '798 do not provide AC outputs, and their parallel connection merely provides a higher DC current at the input of circuit 12. Applicants also note that the Lincoln article and Stava '929 appear silent with respect to parallel welding modules. Consequently, neither the three cited references, nor the combination thereof, teach the parallel AC module concepts of claims 9-16, whereby these claims and claims 41, 42, 48, 49, 61-63, 77-79, and 93-95 are patentably distinct from the proposed combination of the Lincoln article with Stava '929 and Stava '798. For this additional reason, therefore, Applicants request reconsideration of the rejections of these claims under 35 U.S.C. §103.

In addition, there is no motivation for the proposed combination of the Lincoln article with Stava '929 and Stava '798 with respect to claims 9-16, 41, 42, 48, 49, 61-63, 77-79, and 93-95. As discussed above, there is no motivation to employ the teachings of Stava '929 in series welders in general. Furthermore, a person of ordinary skill in the art would not expect success in combining the DC modules of Stava '798 in providing a welding current having an AC waveform. Moreover, the frequency and/or phase adjustment aspects of Stava '929 do not appear combinable with the modular DC aspects of Stava '798. Therefore, Applicants request reconsideration and withdrawal of the rejections of claims 9-16, 41, 42, 48, 49, 61-63, 77-79, and 93-95 under 35 U.S.C. §103 for this additional reason.

III. REJECTION OF CLAIMS 27-30 AND 101-125 UNDER 35 U.S.C. § 103

Claims 27-30 and 101-125 were rejected in the Office Action under 35 U.S.C. §103 as unpatentable over the Lincoln article taken with Stava '929 as applied to claims 1-8, 19-26, 31-40, 43-47, 50-60, 64-76, 80-92, and 96-100 above, and further in view of Outcalt 2,669,640. Applicants submit that the proposed combination fails to teach or suggest all the elements of these claims and further that there is no motivation or suggestion for the combination, whereby reconsideration and withdrawal of these claim rejections is requested for at least the following reasons.

a. Claims 27-30

Claims 27-30 depend indirectly from independent claim 1 discussed above, and further recite separately controlled first and second wire feed speed features, in which the first wire feeder is driven by the main power source and the second wire feeder is driven by the second power source. One possible example of this wire feed drive configuration is illustrated in Fig. 21 of the present application, with the power wave 992 driving a first feeder 760 and power wave 990 driving feeder 762. As discussed above, independent claim 1 is believed to be patentably distinct from the combination of the Lincoln article with Stava '929, since there is no motivation or reasonable expectation for success in attempting the proposed combination of the system of the Lincoln article with the teachings of Stava '929. Outcalt fails to provide such motivation, wherein Outcalt neither discusses nor extols the virtues of welding waveforms provided by a waveform generator controlling a pulse width modulator. For this reason alone, claims 27-30 are therefore non-obvious.

In addition, the dependent claims 27-30 provide that the power sources are each connected to an electrode (by virtue of claims 1, 25, and 26), with the second power source in series between the second electrode and the workpiece (intervening claims 25 and 26). This is not the case in Outcalt, where the welding current source 16 (Fig. 1) does not appear to be connected to the workpiece W. Consequently, the proposed combination of Outcalt with the Lincoln article and Stava '929 fails to teach or suggest this element of claims 27-30, and reconsideration is requested for this additional reason.

Furthermore, claims 27 and 28 recite that the main power source drives the first wire feeder and a second power source drives the said second wire feeder. The Lincoln article

does not show two power sources driving two wire feeders, and Stava '929 appears silent with respect to power sources driving wire feeders. Outcalt appears to provide only a single power source 16. The wire feeders of Outcalt, moreover, do not appear to be driven by the power source. Rather, the rod feed motors 10 of Outcalt are controlled by voltage controls 22, and are not driven by the power source. In this regard, Outcalt provides the following regarding the wire feeder motor drives:

> The workpiece W is not included in the welding current circuit per se. This is accomplished by arranging the electrodes so that their extended longitudinal axes B, B, intersect in the illustrated example at a point C near but above the surface D of the workpiece by a ***distance or space E***, which ***is maintained substantially constant during the welding operation*** so that the welding current is carried between the electrodes principally through the molten flux or deposited metal, rather than any great amount of the total current being carried through the workpiece W in its passage between the electrodes. ***The rods R, R, are automatically fed by the respective motors 10, 10, at such a rate that the voltage between each rod and the work is maintained substantially constant, by, for example, voltage controls 22, 22 having input circuits 24, 24, and output circuits 26, 26. Each input circuit 24 is connected across the workpiece W and a brush 28 in contact with each electrode R. Each output circuit is, likewise, connected to a motor 18.***

(Outcalt col. 3, line 55 through col. 4, line 2, emphasis added). Therefore, Outcalt appears to control the wire feeders to maintain a constant rod-to-work voltage and fails to teach or suggest two power sources, each driving a wire feeder. As this feature is absent from all three cited references, the subject matter of claims 27-30 is not rendered obvious by the proposed combination of Outcalt with the Lincoln article and Stava '929. For this additional reason, therefore, Applicants request reconsideration and withdrawal of the rejections of claims 27-30 under 35 U.S.C. §103.

b. Claims 101-113

Independent claim 101 recites an electric arc welder having a main power source, along with first and second wire feeders to drive first and second electrodes, wherein the first and second wire feed speeds are separately controlled. Claims 102-113 depend from

claim 101. The Office Action proposes to combine the Lincoln article, Stava '929, and Outcalt, and posits that it would have been obvious to have used separately controlled wire feeders, the motivation being the teachings of Outcalt that such is advantageous when feeding two electrodes. As discussed above, there is no suggestion, motivation, or reasonable expectation of success in attempting to combine the series welding system shown in the Lincoln article with the teachings of Stava '929, and Outcalt fails to provide such suggestion, whereby claims 101-113 are patentably distinct from the proposed combination for at least this reason.

In addition, applicants note that claims 110-113 provide that the first wire feeder has a speed control signal created by the main power source and the second wire feeder has a speed control signal created by a second power source. As discussed above in connection with claims 27 and 28, the Lincoln article and Stava '929 appear silent regarding power sources driving wire feeders. In addition, Outcalt does not have two power sources, and the rod feed motors 10 of Outcalt are not driven by the welding source 16 (Outcalt Fig. 1, col. 3, line 55 through col. 4, line 2). Thus, the proposed combination does not teach or suggest all the features of claims 110-113, and these claims are non-obvious for this additional reason. Applicants therefore request reconsideration of the rejections thereof under 35 U.S.C. §103.

c. Claims 114-125

Independent claim 114 is directed to a welder with first and second wire feeders and power sources connected in a modified series arrangement, where the first wire feeder is driven by one of the power sources and the second wire feeder is driven by the other power source. Two examples of this welder architecture are depicted in Applicants' Figs. 20 and 21. Claims 115-125 depend from claim 114, adding further distinguishing features to the electric arc welder. Applicants refer to the above discussion, and again submit that no suggestion, motivation, nor reasonable expectation of success exists in the prior art for attempting to combine the cited Lincoln article with Stava '929 in the context of series welding. As noted above, moreover, Outcalt does not provide such motivation. Therefore claims 114-125 are believed to be patentably distinct for at least this reason.

Claims 114-125 are also non-obvious because the proposed combination does not teach or suggest all the features thereof, and these claims are non-obvious for this additional reason. In this regard, the Lincoln article and Stava '929 do not teach or suggest wire feeders driven by power sources, Outcalt does not have two power sources, and the wire feeders of Outcalt are not driven by a power source. For this additional reason, therefore, reconsideration and withdrawal of the rejections of claims 114-125 is requested under 35 U.S.C. §103.

IV. REJECTION OF CLAIMS 17 AND 18 UNDER 35 U.S.C. § 103

Claims 17 and 18 stand rejected under 35 U.S.C. §103 as unpatentable over the Lincoln article taken with Stava '929 and Stava '798 as applied to claims 9-16, 41, 42, 48, 49, 61-63, 77-79, and 93-95 above, and further in view of Outcalt 2,669,640. Claims 17 and 18 depend from claims 16 and 15, and Applicants refer to the above discussion with respect to independent claim 1 and to claims 9-16, wherein the proposed combination fails to teach or suggest all the elements of these claims and there is no motivation or suggestion for the combination. In particular, the parallel connection of power modules of claims 15 and 16 is neither taught nor suggested by combination of the Lincoln article with Stava '929, Stava '798, and Outcalt clearly does not teach or suggest parallel modules. Thus, the proposed combination of these four references fails to obviate dependent claims 17 and 18. In addition, claims 15 and 16 (and hence claims 17 and 18) involve parallel connection of modules for creation of an AC welding current waveform, whereas the parallel inverters of Stava '798 each provide a portion of a combined DC current that is then fed to a single polarity switching network 12. Consequently, there is no motivation to consult Stava '798 with respect to parallel creation of AC waveforms in the manner set forth in claims 15 and 16. Furthermore, no motivation or reasonable expectation exists for combining Stava '929 with the Lincoln article or with Stava '798, wherein the frequency and/or phase adjustment aspects of Stava '929 do not appear advantageous or even operable with the series connection of the article and the modular DC aspects of Stava '798. For at least these reasons, therefore, claims 17 and 18 are believed to be patentable over the proposed combination of the Lincoln article, Stava '929, Stava '798, and Outcalt.

Claims 17 and 18 further specify that the first power source drives the first wire feeder and the second power source drives the second wire feeder. As set forth above, the Lincoln article does not show how the welding wires are fed, Stava '929 is silent with regard to power sources driving wire feeders, and Outcalt provides only one power source that does not drive either wire feeder. Stava '798 also fails to show wire feeders or how they are driven. Thus, the proposed combination does not teach or suggest all the elements of claims 17 and 18, and Applicants request reconsideration and withdrawal of the rejections thereof under 35 U.S.C. §103 for this additional reason.

CONCLUSION

For at least the above reasons, the currently pending claims are believed to be in condition for allowance and notice thereof is requested.

Should the Examiner feel that a telephone interview would be helpful to facilitate favorable prosecution of the above-identified application, the Examiner is invited to contact the undersigned at the telephone number provided below.

Should any fees be due as a result of the filing of this response, the Commissioner is hereby authorized to charge the Deposit Account Number 06-0308, LEEE200380.

Respectfully submitted,

By: Eric Highman

Robert V. Vickers, Reg. No. 19,504
Eric Highman, Reg. No. 43,672

Fay, Sharpe, Fagan, Minnich & McKee, LLP
1100 Superior Avenue, Seventh Floor
Cleveland, OH 44114-2518
Telephone: 216/861-5582
Facsimile: 216/241-1666

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By: Krista A. Murphy
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